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Applicants: Rabinovich *et al.*

Docket No: EH-10417

Serial No: 09/683,185

Examiner: D. Yee

Filed: 29 November 2001

Art Unit: 1742

Title: Method and Apparatus for Heat Treating
MaterialCommissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

DECLARATION UNDER 37 CFR § 1.132

The undersigned, Albert Rabinovich, declares as follows:

1. I am a coinventor of the present application.
2. I have 10 years of experience in process analysis in the aerospace industry, including 9 years of experience in thermal, structural, and fluid flow analysis in conjunction with manufacturing processes. I received a BS in Mechanical Engineering from the University of Massachusetts at Amherst in 1994; an MS in Mechanical Engineering from Rensselaer Polytechnic Institute in 2000 and an MS in Computer Science from Rensselaer Polytechnic Institute in 2001.
3. I have read and understand and am familiar with the disclosure of U.S. Patent Number 6,394,793 to Bunge ("Bunge") and the disclosure and claims of the present application as previously amended.

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4. Bunge fails to disclose or suggest impingement cooling (as identified in present independent claims 1, 8, 15, and 31 and dependent claim 32). Bunge suggests only a basic forced air cooling regime.
5. At FIGS. 4 and 5 of Bunge, cooling rates are respectively identified for an oil quench and Bunge's air cooling. Bunge's air cooling rates are much lower than the oil cooling rates. These air cooling rates do not evidence heat transfer coefficients significantly higher than the remainder of the forced convection regime as is presently claimed. Impingement cooling rates would be closer to, if not even greater than the oil cooling rates. This confirms Bunge's operation only in a basic forced air cooling regime.
6. Keeping the oil quench in mind, present independent claim 31 identifies "...heat transfer coefficients greater than those created by oil bath quenching." Heat transfer coefficients and cooling rates are related. The exact relationship will depend on a number of factors. However, energy conservation requires that a higher cooling rate will be associated with a higher heat transfer coefficient. Thus because Bunge's air cooling is at a lower rate than the cooling of an oil bath quench, the heat transfer coefficient associated with that air cooling is less than the heat transfer coefficient of the oil bath quench. Bunge also fails to disclose the particular coefficient value of dependent claim 33. Bunge's air cooling would be associated with a much lower coefficient.
7. Present dependent claims 16-19 identify certain dimensional ratios involving the outlet diameter (d). Such ratios are relevant to maintaining operation in the impingement cooling regime. The present specification identifies a nominal 0.065 inch (d) value of 0.055-0.075 inch in paragraph 0052. Actually, in a clear typographical error, the present specification erroneously states "0.55-0.75". Such a large diameter would be inconsistent with the flow rates specified and

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one of ordinary skill in the art would understand that it reflected a dropped decimal place. Bunge does not explicitly or implicitly identify outlet diameter. Interestingly, Bunge does identify values for some of the other relevant parameters. Exploration of these is informative:

- a. The present application identifies a distance between a pipe and the forging as "Z". The Z/d ratio of present claim 16 "is between approximately 1.0 and 6.0." Bunge fails to discuss this ratio and does not suggest the particular range. For the present nominal 0.065 inch hole, this range yields Z of 0.065-0.39 inch. Bunge however identifies a corresponding dimension of "about ¼ to about 6 inches". Col. 6, line 21. This disparity tends to confirm Bunge is operating outside the impingement cooling regime. Furthermore, Bunge's failure to identify the diameter and to identify a ratio at least somewhat similar to that claimed tends to confirm that he had no appreciation of the possibility of achieving the impingement cooling regime.
- b. Claim 17 identifies "adjacent outlets having a spacing (s) therebetween, and s/d is less than approximately 26.0." Claim 18 identifies said spacing as a circumferential spacing (X). Claim 19 identifies said spacing as a radial spacing (Y) and further restricts Y/d as less than approximately 24.0. Bunge identifies nozzles "preferably between approximately 1/16 (one sixteenth) and 2 inches apart from each other..." Col. 6, lines 26-27. Given the broad dimensional range of Bunge's separation and the lack of identifiable diameter, it is impractical to attempt comparison to claims 17-19. However that breadth indicates that Bunge did not find the impingement cooling regime of independent claim 15.

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8. Turning to the Office action of August 20, 2004, at paragraph 8, second subparagraph, the action identified "similar cooling pressures". However, pressures, alone do not determine the impingement cooling regime. The hole size, density, and separation from the part are also relevant. As noted above, certain of the present dependent claims make specific attempts at quantifying appropriate ratios. However, the teachings of the present application are not limited to those examples.

9. The third subparagraph of paragraph 8 of the Office action questioned the relationship between cooling rate and heat transfer coefficient. This is addressed in paragraphs 5 and 6 above.

10. The fifth subparagraph of paragraph 8 of the Office action asserted that "to reduce cooling rate when alloy exits would be a matter of choice..." This statement was made relative to claim 38 which identifies reducing "said cooling rate once said alloy exits a temperature range of a ductility trough." Bunge does generically disclose the possibility of a temporal change in cooling rate associated with a change in pressure (either a decrease or an increase). See col. 8, lines 40-51. However, Bunge fails to specifically suggest a reduction once the alloy exits a ductility trough. This is emphasized by Bunge's ambivalence over increase versus decrease. Also, the change is particularly relevant with the high (at least before the reduction) heat transfer of the impingement cooling which is not present in Bunge.

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11. The undersigned declares further that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Respectfully submitted,

Albert Rabinovich

Albert Rabinovich

Date: 4/6/05